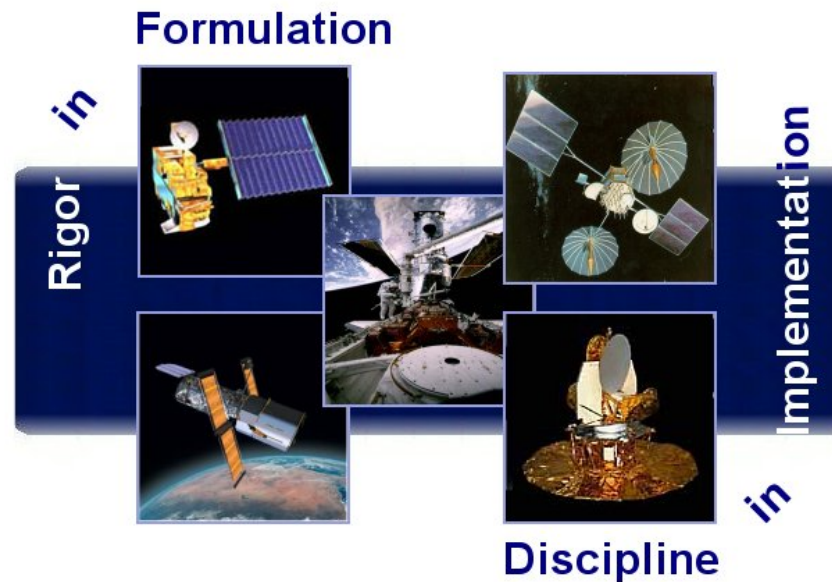
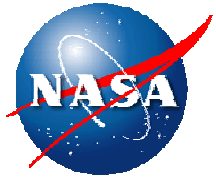




Engineering Unit Verification Approach for GSFC Projects



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Engineering Unit Verification Policy

Objective:

Assure the discovery and correction of unit errors that could preclude mission success

Approach:

1. Document plan for verifying units in System Engineering Management Plan
2. Identify where an error in units could result in loss of mission
3. Decide and document the extent of defenses against the misapplication of units
4. Track the defenses against misapplication of units and correct identified potential mission critical units errors



Defense Against Misapplication of Units

1. Document units philosophy, plan for detecting and correcting potential errors, and implementation responsibility in the Systems Engineering Management Plan or other project controlled document

Philosophy example:

- Flight Subsystems and Operational Software uses SI units
- ICDs use SI units with English equivalent where necessary (typical for some mechanical items and Launch Vehicle)
- Manufacturing drawings are English to enable use of US manufacturing facilities
- Defense against misapplication of units documented in the Systems Engineering Management Plan, implemented and tracked by the Systems Engineering team

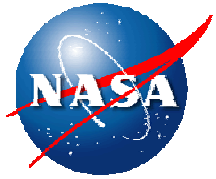


Defense Against Misapplication of Units

2. Identify where an error in units could result in loss of mission

(In addition to hardware, include Flight and Ground Software Parameters, Tables, Commands where units, scale, value or sign could result in loss of mission)

- Identify the functional areas of the System containing mission critical units that could result in the loss of mission should a units error go undetected.
 - Utilize techniques similar to FMEA and/ or FTA to identify Flight and/or Ground elements where incorrect Units, Value, Scale or Sign could result in loss of mission.
 - Identify mission critical units that cross organizational boundaries where ICDs are planned
 - Organizations (LV to Obs, Obs to Ground, S/C to Inst, MOC to FDF, MOC to Obs)
 - Identify mission critical units where ICDs may not exist
 - Disciplines (ACS/Prop to Traj Planning, C&DH to ACS, ACS to S/W, ACS to Prop, Mechanical to Thermal)



Defense Against Misapplication of Units

3. Decide and document the extent of defenses against the misapplication of units

- Design rules
 - Requirements or ICDs that Document Units consistent w/ philosophy
- Reviews
 - Peer Reviews (Validate correct design requirements and correct implementation of actual mission critical units and values)
 - Integrated Independent Reviews (Review what interfaces and what units are controlled along with process used to control units)
- Verification and Validation Testing
 - Identify Where Mission Critical Units do not receive a test.
 - Unit, Build & Acceptance testing to verify proper implementation of units
 - Mission Simulation, End to End Testing, Negative and Contingency testing to validate end item performance in operational scenario
 - Review of Test Results



Defense Against Misapplication of Units

4. Track the defenses against misapplication of units and correct identified potential mission critical units errors

- Provide a mechanism to track the planned defenses against completed activities
- Use established project mechanisms to correct any identified units errors
- Identify any residual risks to loss of mission due to potentially undetected units errors in the project risk management system